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NASA's Space Launch System: Moving Toward the Launch Pad

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Abstract

The National Aeronautics and Space Administration's (NASA's) Space Launch System (SLS) Program, managed at the Marshall Space Flight Center, is making progress toward delivering a new capability for human space flight and scientific missions beyond Earth orbit. Developed with the goals of safety, affordability, and sustainability in mind, the SLS rocket will launch the Orion Multi-Purpose Crew Vehicle (MPCV), equipment, supplies, and major science missions for exploration and discovery. Supporting Orion's first autonomous flight to lunar orbit and back in 2017 and its first crewed flight in 2021, the SLS will evolve into the most powerful launch vehicle ever flown, via an upgrade approach that will provide building blocks for future space exploration and development. NASA is working to develop this new capability in an austere economic climate, a fact which has inspired the SLS team to find innovative solutions to the challenges of designing, developing, fielding, and operating the largest rocket in history. This paper will summarize the planned capabilities of the vehicle, the progress the SLS program has made in the 2 years since the Agency formally announced its architecture in September 2011, and the path the program is following to reach the launch pad in 2017 and then to evolve the 70 metric ton (t) initial lift capability to 130-t lift capability. The paper will explain how, to meet the challenge of a flat funding curve, an architecture was chosen which combines the use and enhancement of legacy systems and technology with strategic new development projects that will evolve the capabilities of the launch vehicle. This approach reduces the time and cost of delivering the initial 70 t Block 1 vehicle, and reduces the number of parallel development investments required to deliver the evolved version of the vehicle. The paper will outline the milestones the program has already reached, from developmental milestones such as the manufacture of the first flight hardware and the record-breaking testing of the J-2X engine, to life-cycle milestones such as the vehicle's Preliminary Design Review. The paper will also discuss the remaining challenges in both delivering the 70 t vehicle and in evolving its capabilities to the 130 t vehicle, and how the program plans to accomplish these goals. As this paper will explain, SLS is making measurable progress toward becoming a global infrastructure asset for robotic and human scouts of all nations by harnessing business and technological innovations to deliver sustainable solutions for space exploration.